```
KP .2;
KI .05;
KD 0;
HPB=0;
RPB=0;
XYHomed=0;
IdleTM=0;
ITime=0;
JS #INITGL
JS #INITWL
EN;
rem End #INIT1 **************
rem *** Inertia Friction Welding Inc
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rem
#WELD1
HX ;
RPB=0;
MG "Weld Cycle Started"
ER"=WeldFE;
OE"=1;
rem
TL WeldTL;
GN WeldGN;
SP WeldSP;
AC WeldAC;
DC WeldDC;
KP WeldKP;
KI WeldKI;
KD WeldKD;
Dist=PPR*WeldRev;
Dist2=Dist-(PPR*TrigRev);
PR Dist;
TW 500;
BGX;
MG "Scrub . . "
rem Scrub start
AT 0;
AT ScrubTM;
rem Burn start
CB1;
MG "Burn . . . "
AD Dist2;
rem WT500
rem Forge Start
CB 2;
SB 1;
MG "Forge . . . "
AMX;
KP WeldKP2;
WT ForgeTM;
SB 2
MG "Weld complete"
WT 10000
KP WeldKP;
EN;
rem End #WELD; ****************
rem
#CYCLE
JS #HOME_XYHome=1
JS #WELD1;
XQ #IDLE,1
EN
rem End #CYCLE ****************
#MCTIME
MG "Position timeout . . . "
RE
rem End WELD.CYCLE MODULE ********
rem
#INITGL
rem
rem GLOBAL VARIABLES
rem
rem
rem PULSES PER INCH
PPI=1000.000000
rem PULSES PER REV
PPR=7941.22449
```



```
rem Timer Ticks Per Second
TPS=1000
rem    Input Volts Per Unit
IVUPRPM=2.000000
IVUPPSI=3.000000
rem    Output Volts Per Unit
OVUPRPM=2.000000
OVUPPSI=3.000000
rem Sample Rate
SampleRt=100
rem Number of IO
rem Homing following error counts
HomeFE=2000;
HomeVel=1000;
HomeAcc=500;
HomeDec=500;
HomeP=.8;
HomeI=.02;
HomeD=2;
GHomeVel=1000;
FIVel=1000;
rem Software limits
XFLimit=11.000
YFLimit=11.000
XBLimit=-0.100
YBLimit=-0.100
InvertIO=1
rem Max Move Values
MaxXMVel=10
MaxXMAcc=40
MaxXMDec=40
EN
rem
rem Weld start values
#INITWL
rem *** Inertia Friction Welding Inc
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rem
rem Weld specific params
WeldRPM=1750
ScrubTM=2000;
ForgeTM=4000;
WeldRevS=10
Degrees=0
TrigRev=0.5
rem
rem PID params
WeldAcc=100
WeldDec=100
WeldKP=0.5
WeldKP2=1
WeldKI=0.02
WeldKD=50
WeldFErr=1.5
WeldTL=9.9988
WeldGN=20
rem
rem Calculated parameters
WeldRev=(Degrees/360)*WeldRevS;
WeldSP=(WeldRPM*PPR)/60;
WeldAC=(WeldAcc*PPR)/60;
WeldDC=(WeldDec*PPR)/60;
WeldFE=WeldFErr*PPR;
rem
rem End weld.txt ************
EN
rem End #INITLW ****************
```

APPENDIX

```
rem *** Inertia Friction Welding Inc
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rem
rem
rem *** Inertia Friction Welding Inc
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rem
rem *** #MAIN
rem This is the main program task
#MAIN
JS #INIT
XQ #IDLE,1
#MAIN1
JS #CYCLE,@IN[1]=0;
JS #HOME,HPB=1;
JS #WELD1,RPB=1;
JP #MAIN1
EN
rem End #MAIN**********
rem *** Inertia Friction Welding Inc
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rem
rem *** #HOME
rem Home function
#HOME
HX 1;
HPB=0;
MG "HOME"
XYHomed=0;
HomeIP=1;
Revt.Set;Fevt.Set;
ER HomeFE;
AC HomeAcc;
DC HomeDec;
KP HomeP;
KI HomeI;
KD HomeD;
IL 2;VT 1;
#HOMEX
MG "Homing . . . ";
```

APPENDIX-continued

```
Sta:Msg="HOMEX:"
rem Make sure of home switch
MG "Get off home switch . . . ";
JG #VEL;BGX;
#WFX2:JP #WFX2,@IN[2]=0;
WT 500
STX,AMX:JP #HOMEX,@IN[2]=0;
MG "Off Home switch . . . ";
rem Find home LS
MG "Looking for home switch . . . ";
#WFX1:
PR -5;BGX;AMX;
JP #WFX1,@IN[2]=1;XPos= TPX;
MG "Home switch found . . . ";
rem
rem Go back to home position
SP #VEL;
PA XPos;BG;AM;DP0;
MG "Slides Homed . . . "
#HOME1
XYHomed=1;
XQ #IDLE,;
EN
rem End #HOME**********
rem *** Inertia Friction Welding Inc
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rem
rem *** #POSERR
rem Position following error
#POSERR
ZS;
JS #HALT;
MG "FOLLOWING ERROR"
Sta:Msg="FOLERR"
ZS;Jp #MAIN;
RE
rem End #POSERR **********
rem *** Inertia Friction Welding Inc
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rem
rem *** #HALT
rem Brings motion to a stop
#HALT
Sta:Msg="HALT"
ER*=1000;II 0;AB 1;WT 1000;
SH;CS;HX 1;MO;
OP255;
rem JS #CLEARIO;
MG "Servo program halted . . . "
EN
rem end #HALT**********
rem *** Inertia Friction Welding Inc
rem *** Copyright 1996
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rem
#IDLE
IdleTM=TIME
#IDLE1
JP #IDLE1,TIME-IdleTM<1000;
ITime=ITime-1;
MG "Servo Ready . . . ",ITime(F6)
JP #IDLE;
EN
rem End #IDLE **********
rem *** Inertia Friction Welding Inc
rem *** Copyright 1996
rem *** All rights reserved
rem
#INIT
SB 1;SB 2;SB 3;SB 4;
SB 5;SB 6;SB 7;SB 8;
ER*=1000;
OE*=1;
TL 1;
GN 1;
AC 500;
DC 500;
```